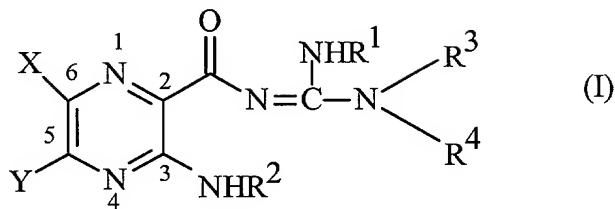


CLAIMS:

1. A compound represented by formula (I):



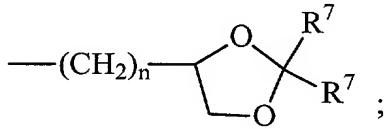
wherein

X is hydrogen, halogen, trifluoromethyl, lower alkyl, unsubstituted or substituted phenyl, lower alkyl-thio, phenyl-lower alkyl-thio, lower alkyl-sulfonyl, or phenyl-lower alkyl-sulfonyl;

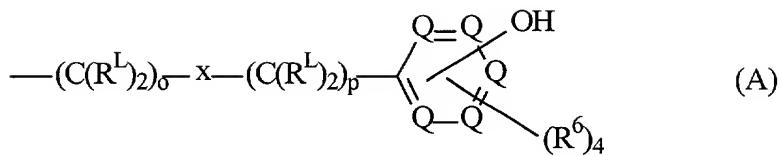
Y is hydrogen, hydroxyl, mercapto, lower alkoxy, lower alkyl-thio, halogen, lower alkyl, unsubstituted or substituted mononuclear aryl, or $\text{-N}(\text{R}^2)_2$;

R^1 is hydrogen or lower alkyl;

each R^2 is, independently, -R^7 , $\text{-(CH}_2\text{)}_m\text{-OR}^8$, $\text{-(CH}_2\text{)}_m\text{-NR}^7\text{R}^{10}$, $\text{-(CH}_2\text{)}_n(\text{CHOR}^8)(\text{CHOR}^8)_n\text{-CH}_2\text{OR}^8$, $\text{-(CH}_2\text{CH}_2\text{O)}_m\text{-R}^8$, $\text{-(CH}_2\text{CH}_2\text{O)}_m\text{-CH}_2\text{CH}_2\text{NR}^7\text{R}^{10}$, $\text{-(CH}_2\text{)}_n\text{C(=O)NR}^7\text{R}^{10}$, $\text{-(CH}_2\text{)}_n\text{-Z}_g\text{-R}^7$, $\text{-(CH}_2\text{)}_m\text{-NR}^{10}\text{-CH}_2\text{(CHOR}^8)(\text{CHOR}^8)_n\text{-CH}_2\text{OR}^8$, $\text{-(CH}_2\text{)}_n\text{-CO}_2\text{R}^7$, or

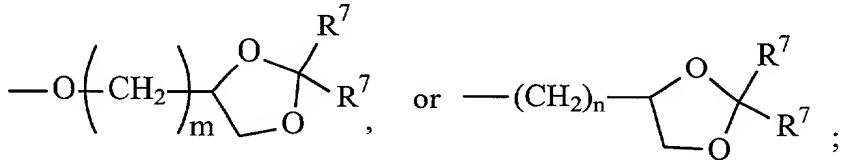


15 R^3 and R^4 are each, independently, hydrogen, a group represented by formula (A), lower alkyl, hydroxy lower alkyl, phenyl, phenyl-lower alkyl, (halophenyl)-lower alkyl, lower-(alkylphenylalkyl), lower alkoxyphenyl)-lower alkyl, naphthyl-lower alkyl, or pyridyl-lower alkyl, with the proviso that at least one of R^3 and R^4 is a group represented by formula (A):



wherein

each R^L is, independently, $-R^7$, $-(CH_2)_n-OR^8$, $-O-(CH_2)_m-OR^8$,
 $-(CH_2)_n-NR^7R^{10}$, $-O-(CH_2)_m-NR^7R^{10}$, $-(CH_2)_n(CHOR^8)(CHOR^{10})_n-CH_2OR^8$,
 $-O-(CH_2)_m(CHOR^8)(CHOR^{10})_n-CH_2OR^8$, $-(CH_2CH_2O)_m-R^8$,
 $-O-(CH_2CH_2O)_m-R^8$, $-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$,
 $-O-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$, $-(CH_2)_n-C(=O)NR^7R^{10}$,
 $-O-(CH_2)_m-C(=O)NR^7R^{10}$, $-(CH_2)_n-(Z)_g-R^7$, $-O-(CH_2)_m-(Z)_g-R^7$,
 $-(CH_2)_n-NR^{10}-CH_2(CHOR^8)(CHOR^{10})_n-CH_2OR^8$,
 $-O-(CH_2)_m-NR^{10}-CH_2(CHOR^8)(CHOR^{10})_n-CH_2OR^8$,
 $-(CH_2)_n-CO_2R^7$, $-O-(CH_2)_m-CO_2R^7$, $-OSO_3H$, $-O$ -glucuronide, $-O$ -glucose, or



each x is, independently, O , NR^7 , $C=O$, $CHOH$, $C=N-R^6$, or represents a single bond;

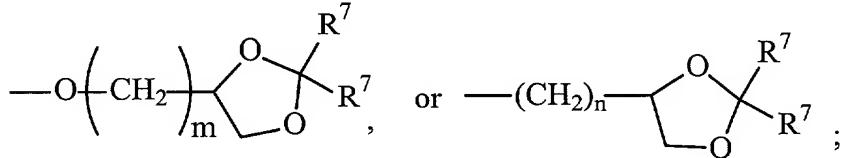
each o is, independently, an integer from 0 to 10;

each p is, independently, an integer from 0 to 10;

15 with the proviso that (a) the sum of o and p in each contiguous chain is from 1 to 10 when x is O , NR^7 , $C=O$, or $C=N-R^6$ or (b) that the sum of o and p in each contiguous chain is from 4 to 10 when x represents a single bond;

each R^6 is, independently, $-R^7$, $-OH$, $-OR^{11}$, $-N(R^7)_2$, $-(CH_2)_m-OR^8$,
 $-O-(CH_2)_m-OR^8$, $-(CH_2)_n-NR^7R^{10}$, $-O-(CH_2)_m-NR^7R^{10}$,
 $-(CH_2)_n(CHOR^8)(CHOR^{10})_n-CH_2OR^8$, $-O-(CH_2)_m(CHOR^8)(CHOR^{10})_n-CH_2OR^8$,
 $-(CH_2CH_2O)_m-R^8$, $-O-(CH_2CH_2O)_m-R^8$, $-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$,
 $-O-(CH_2CH_2O)_m-CH_2CH_2NR^7R^{10}$, $-(CH_2)_n-C(=O)NR^7R^{10}$,

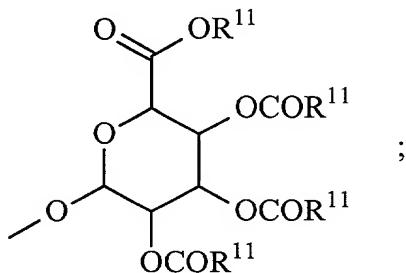
$-\text{O}-(\text{CH}_2)_m-\text{C}(=\text{O})\text{NR}^7\text{R}^{10}$, $-(\text{CH}_2)_n-(\text{Z})_g-\text{R}^7$, $-\text{O}-(\text{CH}_2)_m-(\text{Z})_g-\text{R}^7$,
 $-(\text{CH}_2)_n-\text{NR}^{10}-\text{CH}_2(\text{CHOR}^8)(\text{CHOR}^8)_n-\text{CH}_2\text{OR}^8$,
 $-\text{O}-(\text{CH}_2)_m-\text{NR}^{10}-\text{CH}_2(\text{CHOR}^8)(\text{CHOR}^8)_n-\text{CH}_2\text{OR}^8$,
 $-(\text{CH}_2)_n-\text{CO}_2\text{R}^7$, $-\text{O}-(\text{CH}_2)_m-\text{CO}_2\text{R}^7$, $-\text{OSO}_3\text{H}$, $-\text{O}-\text{glucuronide}$, $-\text{O}-\text{glucose}$,



5 wherein when two R^6 are $-\text{OR}^{11}$ and are located adjacent to each other on a phenyl ring, the alkyl moieties of the two R^6 may be bonded together to form a methylenedioxy group;

each R^7 is, independently, hydrogen or lower alkyl;

10 each R^8 is, independently, hydrogen, lower alkyl, $-\text{C}(=\text{O})-\text{R}^{11}$, glucuronide, 2-tetrahydropyranyl, or



each R^9 is, independently, $-\text{CO}_2\text{R}^7$, $-\text{CON}(\text{R}^7)_2$, $-\text{SO}_2\text{CH}_3$, or $-\text{C}(=\text{O})\text{R}^7$;

each R^{10} is, independently, $-\text{H}$, $-\text{SO}_2\text{CH}_3$, $-\text{CO}_2\text{R}^7$, $-\text{C}(=\text{O})\text{NR}^7\text{R}^9$,

$-\text{C}(=\text{O})\text{R}^7$, or $-\text{CH}_2-(\text{CHOH})_n-\text{CH}_2\text{OH}$;

15 each Z is, independently, CHOH , $\text{C}(=\text{O})$, $\text{CHNR}^7\text{R}^{10}$, $\text{C}=\text{NR}^{10}$, or NR^{10} ;

each R^{11} is, independently, lower alkyl;

each g is, independently, an integer from 1 to 6;

each m is, independently, an integer from 1 to 7;

each n is, independently, an integer from 0 to 7;

each Q is, independently, $\text{C}-\text{R}^5$, $\text{C}-\text{R}^6$, or a nitrogen atom, wherein at

20 most three Q in a ring are nitrogen atoms;

or a pharmaceutically acceptable salt thereof, and
inclusive of all enantiomers, diastereomers, and racemic mixtures thereof.

2. The compound of Claim 1, wherein Y is -NH₂.
- 5 3. The compound of Claim 2, wherein R² is hydrogen.
4. The compound of Claim 3, wherein R¹ is hydrogen.
5. The compound of Claim 4, wherein X is chlorine.
6. The compound of Claim 5, wherein R³ is hydrogen.
7. The compound of Claim 6, wherein each R^L is hydrogen.
8. The compound of Claim 7, wherein o is 4.
9. The compound of Claim 8, wherein p is 0.
10. The compound of Claim 9, wherein x represents a single bond.
11. The compound of Claim 10, wherein each R⁶ is hydrogen.
12. The compound of Claim 11, wherein at most one Q is a nitrogen atom.
- 15 13. The compound of Claim 12, wherein no Q is a nitrogen atom.
14. The compound of Claim 1, wherein
X is halogen;
Y is -N(R⁷)₂;
- 15 R¹ is hydrogen or C₁-C₃ alkyl; and
R² is -R⁷, -(CH₂)_m-OR⁷, or -(CH₂)_n-CO₂R⁷;

R³ is a group represented by formula (A); and

R⁴ is hydrogen, a group represented by formula (A), or lower alkyl;

15. The compound of Claim 14, wherein

X is chloro or bromo;

5 Y is -N(R⁷)₂;

R² is hydrogen or C₁-C₃ alkyl;

at most three R⁶ are other than hydrogen as defined above;

at most three R^L are other than hydrogen as defined above; and

at most 2 Q are nitrogen atoms.

16. The compound of Claim 15, wherein Y is -NH₂.

17. The compound of Claim 16, wherein

R⁴ is hydrogen;

at most one R^L is other than hydrogen as defined above;

at most two R⁶ are other than hydrogen as defined above; and

at most 1 Q is a nitrogen atom.

18. The compound of Claim 17, wherein x is O, NR⁷, C=O, CHO, or C=N-R⁶.

19. The compound of Claim 17, wherein x represents a single bond.

20. The compound of Claim 1, wherein x is O, NR⁷, C=O, CHO, or C=N-R⁶.

21. The compound of Claim 1, wherein x represents a single bond.

20

22. The compound of Claim 1, wherein each R⁶ is hydrogen.

23. The compound of Claim 1, wherein at most two R⁶ are other than hydrogen as defined in Claim 1.

24. The compound of Claim 1, wherein one R⁶ is other than hydrogen as defined in Claim 1.

25. The compound of Claim 1, wherein one R⁶ is -OH.

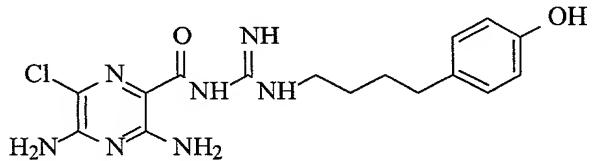
26. The compound of Claim 1, wherein each R^L is hydrogen.

5 27. The compound of Claim 1, wherein at most two R^L are other than hydrogen as defined in Claim 1.

28. The compound of Claim 1, wherein one R^L is other than hydrogen as defined in Claim 1.

10 29. The compound of Claim 1, wherein x represents a single bond and the sum of o and p is 4 to 6.

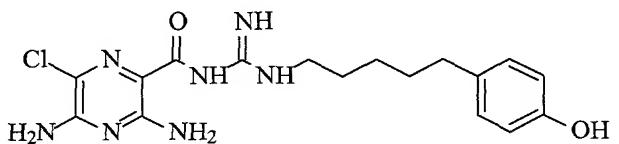
30. The compound of Claim 1, which is represented by the formula



31. The compound of Claim 30, which is in the form of a pharmaceutically acceptable salt.

32. The compound of Claim 31, which is in the form of a hydrochloride salt.

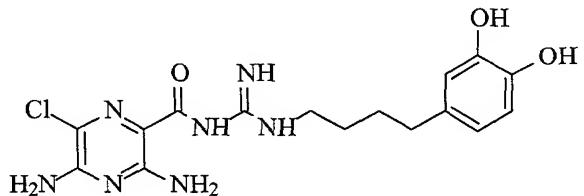
15 33. The compound of Claim 1, which is represented by the formula



34. The compound of Claim 33, which is in the form of a pharmaceutically acceptable salt.

35. The compound of Claim 34, which is in the form of a hydrochloride salt.

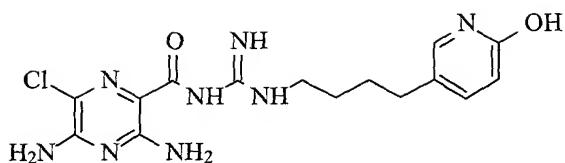
36. The compound of Claim 1, which is represented by the formula



5 37. The compound of Claim 36, which is in the form of a pharmaceutically acceptable salt.

38. The compound of Claim 37, which is in the form of a hydrochloride salt.

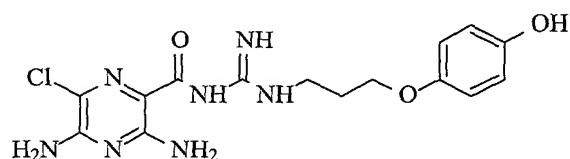
39. The compound of Claim 1, which is represented by the formula



40. The compound of Claim 39, which is in the form of a pharmaceutically acceptable salt.

41. The compound of Claim 40, which is in the form of a hydrochloride salt.

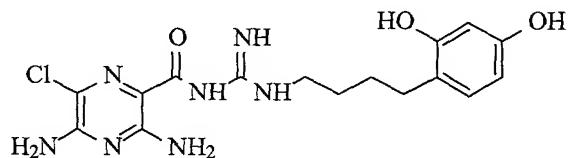
42. The compound of Claim 1, which is represented by the formula



5 43. The compound of Claim 42, which is in the form of a pharmaceutically acceptable salt.

44. The compound of Claim 43, which is in the form of a hydrochloride salt.

45. The compound of Claim 1, which is represented by the formula



46. The compound of Claim 45, which is in the form of a pharmaceutically acceptable salt.

47. The compound of Claim 46, which is in the form of a hydrochloride salt.

5 48. The compound of Claim 1, which is in the form of a pharmaceutically acceptable salt.

10 49. A pharmaceutical composition, comprising the compound of Claim 1 and a pharmaceutically acceptable carrier.

15 50. A method of promoting hydration of mucosal surfaces, comprising:
 administering an effective amount of the compound of Claim 1 to a mucosal surface of a subject.

20 51. A method of restoring mucosal defense, comprising:
 topically administering an effective amount of the compound of Claim 1 to a mucosal surface of a subject in need thereof.

25 52. A method of blocking sodium channels, comprising:
 contacting sodium channels with an effective amount of the compound of Claim 1.

30 53. A method of treating chronic bronchitis, comprising:
 administering an effective amount of the compound of Claim 1 to a subject in need thereof.

35 54. A method of treating cystic fibrosis, comprising:
 administering an effective amount of the compound of Claim 1 to a subject in need thereof.

55. A method of treating sinusitis, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

56. A method of treating vaginal dryness, comprising:

administering an effective amount of the compound of Claim 1 to the vaginal tract of a subject in need thereof.

57. A method of treating dry eye, comprising:

administering an effective amount of the compound of Claim 1 to the eye of a subject in need thereof.

58. A method of promoting ocular hydration, comprising:

administering an effective amount of the compound of Claim 1 to the eye of a subject.

59. A method of promoting corneal hydration, comprising:

administering an effective amount of the compound of Claim 1 to the eye of a subject.

60. A method of promoting mucus clearance in mucosal surfaces, comprising:

administering an effective amount of the compound of Claim 1 to a mucosal surface of a subject.

61. A method of treating Sjogren's disease, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

20 62. A method of treating distal intestinal obstruction syndrome, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

63. A method of treating dry skin, comprising:

administering an effective amount of the compound of Claim 1 to the skin of a subject in need thereof.

64. A method of treating esophagitis, comprising:

5 administering an effective amount of the compound of Claim 1 to a subject in need thereof.

65. A method of treating dry mouth (xerostomia), comprising:

administering an effective amount of the compound of Claim 1 to the mouth of a subject in need thereof.

10 66. A method of treating nasal dehydration, comprising:

administering an effective amount of the compound of Claim 1 to the nasal passages of a subject in need thereof.

15 67. The method of Claim 66, wherein the nasal dehydration is brought on by administering dry oxygen to the subject.

68. A method of preventing ventilator-induced pneumonia , comprising:

administering an effective amount of the compound of Claim 1 to a subject on a ventilator.

69. A method of treating asthma, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need 20 thereof.

70. A method of treating primary ciliary dyskinesia, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

71. A method of treating otitis media, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

5 72. A method of inducing sputum for diagnostic purposes, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

73. A method of treating chronic obstructive pulmonary disease, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

10

74. A method of treating emphysema, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

15

75. A method of treating pneumonia, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

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76. A method of treating constipation, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

25

77. The method of Claim 76, wherein the compound is administered orally or via a suppository or enema.

78. A method of treating chronic diverticulitis, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

79. The present invention also provides a method of treating rhinosinusitis, comprising:

administering an effective amount of the compound of Claim 1 to a subject in need thereof.

5 80. A composition, comprising:
the compound of Claim 1; and
a P2Y2 inhibitor.

10 81. A composition, comprising:
the compound of Claim 1; and
a bronchodilator.